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512 Liberty Lane, West Kingston, RI 02892

Phone: 401 783-4011 Fax: 401 783-7644

E-Mail: [grc@grc.org](mailto:grc@grc.org)

World Wide Web: <http://www.grc.org>

**Nancy Ryan Gray, Ph.D.**  
Director

**2006 GORDON RESEARCH CONFERENCE**  
**on**  
**CERAMICS, SOLID STATE STUDIES IN**

**FINAL PROGRESS REPORT**  
OFFICE OF NAVAL RESEARCH  
GRANT NO. N00014-06-1-0141

The Gordon Research Conference (GRC) on CERAMICS, SOLID STATE STUDIES IN was held at Proctor Academy from 8/13/2006 thru 8/18/2006. The Conference was well-attended with 101 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. Attached is a copy of the formal schedule and speaker program and the poster program. In addition to these formal interactions, "free time" was scheduled to allow informal discussions. Such discussions are fostering new collaborations and joint efforts in the field.

I want to personally thank you for your support of this Conference. As you know, in the interest of promoting the presentation of unpublished and frontier-breaking research, Gordon Research Conferences does not permit publication of meeting proceedings. If you wish any further details, please feel free to contact me. Thank you.

Sincerely,  
**JOHN E BLENDELL**  
PURDUE UNIVERSITY

**20061127112**

# **Ceramics, Solid State Studies In**

## **Optimization of Performance through Microstructural Design**

August 13-18, 2006  
Proctor Academy  
Andover, NH

Chair: **John E Blendell**  
Vice Chair: **Robert F Cook**

### **Overview**

The Gordon Research Conference on Solid State Studies in Ceramics, August 13th to 18th, 2005 will focus on the Optimization of Properties through Microstructure Design. While one of the basic principles of Ceramic Science has been that the properties and performance of ceramic materials can be manipulated through control of the microstructure, the ability to predict the performance of specific microstructures remains limited. A more critical problem is that the ability to design a realistic microstructure which will optimize the performance of a material is virtually nonexistent. With the recent interest in thin film applications and nanostructured materials, question naturally emerge of how their microstructures can be modified for these systems and the relationship of specific microstructural details to the properties have taken on an important role. In addition, recent research has shown that there are local measures of the microstructure which may strongly correlate with the properties but which are difficult or not usually measured. These local measures are the next step in microstructure characterization beyond the standard metrics such as grain size and grain size distribution; crystallographic texture, phase content and phase distribution; and porosity, pore size and pore location. For example, the grain boundary character distribution which gives a measure of the energy of the grain boundaries formed and pair correlation functions which yield information on the local grain texture both have potential to extend our understanding of the interaction of microstructure and properties and offer directions for processing research to control these metrics. Another advance is in understanding the distribution of second phases at interfaces where critical wetting models, surface adsorption and partial wetting all have been shown to occur, but the design of microstructures using these models has not yet been accomplished. In order to address these issues, this conference will bring together a wide range of researchers who are developing modeling techniques to understand how the microstructure develops, researchers who are producing new and unique microstructures, and researchers who are measuring the properties of these advanced materials with the goal of being able to design unique microstructures which will led to optimum properties.

### **SUNDAY**

- |                    |   |
|--------------------|---|
| 2:00 pm - 11:00 pm | Arrival and Check-in  |
| 6:00 pm            | Dinner  |
| 7:30 pm - 7:40 pm  | Welcome / Introductory Comments   |
| 7:40 pm - 9:30 pm  | <b>Modeling and Simulation of Grain Growth</b><br>Discussion Leader: <b>Catherine Bishop</b> (Oxford Univ, Oxford UK)       |
| 7:40 pm - 8:20 pm  | <b>James Warren</b> (NIST, Gaithersburg MD)<br>"Phase Field Modeling of Polycrystals"                                       |
| 8:20 pm - 8:35 pm  | Discussion  |
| 8:35 pm - 9:15 pm  | <b>Veena Tikare</b> (Sandia National Lab., Albuquerque NM)<br>"Statistical-Mechanical Modeling of Microstructure Evolution" |
| 9:15 pm - 9:30 pm  | Discussion  |

### **MONDAY**

- |                    |   |
|--------------------|---|
| 7:30 am - 8:30 am  | Breakfast                                     |
| 8:30 am            | Group Photo                                   |
| 9:00 am - 12:30 pm | <b>Computational Design of Microstructure</b> |

Discussion Leader: **W. Craig Carter** (MIT, Cambridge MA)  
9:00 am - 10:00 am **David Wu** (Yale Univ. New Haven CT)  
"Statistical Grain Growth Laws for Modeling the Coarsening of Microstructures"

10:00 am - 10:30 am Discussion

10:30 am Coffee Break

11:00 am - 12:00 pm **R. Edwin García** (Purdue U. West Lafayette IN)  
"Microstructure Design of Electrically Active Materials"

12:00 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 6:00 pm Free Time

6:00 pm Dinner

7:30 pm - 8:30 pm **Continuation of Rowland Cannon's Research**

Discussion Leader: **Randy Hay** (Air Force Research Lab., Dayton OH)

7:30 pm - 7:45 pm **W. Craig Carter** (MIT, Cambridge MA)  
"Everything about Interfaces and in Between"

7:45 pm - 8:00 pm **Jian Luo** (Clemson Univ. Clemson SC)  
"Quasi-liquid Interfacial Films and Activated Sintering"

8:00 pm - 8:15 pm **Yet-Ming Chiang** (MIT, Cambridge MA)  
"Surficial Films"

8:15 pm - 8:30 pm Discussion

8:30 pm - 9:30 pm **Brief Poster Presentations**

Discussion Leader: **Robert Cook** (NIST, Gaithersburg MD)

9:30 pm - 11:00 pm Poster Session

## TUESDAY

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **Grain Growth Control in Bulk Materials**

Discussion Leader: **Helen Chan** (Lehigh U., Lehigh PA)

9:00 am - 9:40 am **Susan Trolier-McKinstry** (Penn. State U., State College PA)  
"Patterning Ceramics by Microcontact Printing and Patterned Grain Growth"

9:40 am - 10:00 am Discussion

10:00 am Coffee Break

10:30 am - 11:10 am **Suk-Joong Kang** (KAIST, Deajong South Korea)  
"Microstructural Design in Ceramics via Control of Interface Structure and Defects"

11:10 am - 11:30 am Discussion

11:30 am - 12:10 pm **Martin Harmer** (Lehigh Univ., Lehigh PA)  
"Mechanisms of 'Solid State' Single Crystal Conversion"

12:10 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 6:00 pm Free Time

6:00 pm Dinner

7:30 pm - 9:30 pm **Interfaces and Grain Boundaries**

Discussion Leader: **Susan Sinnott** (U. Florida, Gainesville FL)

7:30 pm - 8:10 pm **Z.L. Wang** (Georgia Tech., Atlanta GA)  
"Novel Nanostructures of Functional Oxides - from Synthesis, Growth Mechanisms, Properties to Nanodevices"

- 8:10 pm - 8:30 pm Discussion
- 8:30 pm - 9:10 pm **I-Wei Chen** (U. Pennsylvania, Philadelphia PA)  
"Controlled Grain Growth in Nanomaterials"
- 9:10 pm - 9:30 pm Discussion

### WEDNESDAY

- 7:30 am - 8:30 am Breakfast
- 9:00 am - 12:30 pm **Thin Films**  
Discussion Leader: **Susanne Stemmer** (UCSB, Santa Barbara CA)
- 9:00 am - 9:40 am **Glen Fox** (Ramtron Corp., Colorado Springs CO)  
"Thin Films Texture and Scaling Effects in Ferroelectric Random Access Memory"
- 9:40 am - 10:00 am Discussion
- 10:00 am Coffee Break
- 10:30 am - 11:10 am **Marcel Rost** (U. Leiden, Leiden The Netherlands)  
"Seeing Thin Films Evolve with Real-Time, In-Situ STM: Film Growth and Grain Growth"
- 11:10 am - 11:30 am Discussion
- 11:30 am - 12:10 pm **Paul Salvador** (Carnegie Melon U., Pittsburgh PA)  
"Thin Film Deposition and Growth"
- 12:10 pm - 12:30 pm Discussion
- 12:30 pm Lunch
- 1:30 pm - 6:00 pm Free Time
- 6:00 pm Dinner
- 7:30 pm - 9:30 pm **Characteristics of Microstructure**  
Discussion Leader: **Greg Rohrer** (Carnegie Melon U., Pittsburgh PA )
- 7:30 pm - 8:10 pm **Pat Patterson** (U. Alabama, Birmingham AL)  
"Topological Affinities in Grain Growth"
- 8:10 pm - 8:30 pm Discussion
- 8:30 pm - 9:10 pm **Brent Adams** (Brigham Young U, Salt Lake UT)  
"Pair Correlation Functions and Second-Order Homogenization Relations for Polycrystals"
- 9:10 pm - 9:30 pm Discussion

### THURSDAY

- 7:30 am - 8:30 am Breakfast
- 8:30 am - 9:00 am Business Meeting  
(Nominations for the next Vice Chair; Fill out Conference Evaluation Forms; Discuss future Site & Scheduling preferences; Election of the next Vice Chair)
- 9:00 am - 12:30 pm **Fuel Cells**  
Discussion Leader: **John Halloran** (U. Michigan, Ann Arbor MI)
- 9:00 am - 10:00 am **Jürgen Fleig** (TU Wien, Vienna Austria)  
"Micropatterned Thin Film Electrodes in Solid Oxide Fuel Cell Research: Experiments and Modeling"
- 10:00 am - 10:30 am Discussion
- 10:30 am Coffee Break
- 11:00 am - 12:00 pm **Katsuyo Thornton** (U. Michigan, Ann Arbor MI)  
"Experiments and Simulations of Three-Dimensional Microstructures of Solid Oxide Fuel Cell Electrodes"
- 12:00 pm - 12:30 pm Discussion

12:30 pm Lunch

1:30 pm - 6:00 pm Free Time

6:00 pm Dinner

7:30 pm - 9:30 pm **Thursday Evening Speaker**

Discussion Leader: **John Blendell** (Purdue U., West Lafayette IN)

**Tom Turpin** (Purdue Univ. West Lafayette, IN)

"Insects and the World Food Supply"

Discussion

## FRIDAY

7:30 am - 8:30 am Breakfast

9:00 am Depart

# CERAMICS, SOLID STATE STUDIES IN

Proctor Academy  
Aug 13-18, 2006

Name	Organization	Participation	Status
MONIKA BACKHAUS	CORNING INCORPORATED	Poster Presenter	Registered
KANTESH BALANI	FLORIDA INTERNATIONAL UNIVERSITY	Poster Presenter	Registered
PRABEER MR BARPANDA	RUTGERS UNIVERSITY	Poster Presenter	Registered
SANDIP BASU	DREXEL UNIVERSITY	Poster Presenter	Registered
SHANTANU K BEHERA	LEHIGH UNIVERSITY	Poster Presenter	Registered
MICHAEL A BESTOR	THE UNIVERSITY OF ALABAMA	Attendee	Registered
ABHILASHA AB BHARDWAJ	CARNEGIE MELLON UNIVERSITY	Attendee	Registered
DUNBAR P BIRNIE	RUTGERS UNIVERSITY	Attendee	Registered
CATHERINE M BISHOP	OXFORD UNIVERSITY	Speaker	Registered
JOHN E BLENDALL	PURDUE UNIVERSITY	Chair	Registered
NINA BURBURE	CARNEGIE MELLON UNIVERSITY	Poster Presenter	Registered
W. CRAIG CARTER	MIT	Discussion Leader	Registered
HELEN M CHAN	LEHIGH UNIVERSITY	Discussion Leader	Registered
SIU-WAI CHAN	COLUMBIA UNIV.	Poster Presenter	Registered
YOK CHEN	U S DEPARTMENT OF ENERGY	Attendee	Registered
I.-WEI CHEN	UNIVERSITY OF PENNSYLVANIA	Speaker	Registered
HSUN-YI CHEN	UNIVERSITY OF MICHIGAN	Poster Presenter	Registered
YET-MING CHIANG	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	Attendee	Registered
TIMOTHY E CHIN	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	Poster Presenter	Registered
WAI-YIM CHING	UNIVERSITY OF MISSOURI-KANSAS CITY	Poster Presenter	Registered
SUKWON CHOI	CARNEGIE MELLON UNIVERSITY	Poster Presenter	Registered
ROBERT F COOK	NIST	Vice Chair	Registered
CHRISTOPHER B DIANTONIO	SANDIA NATIONAL LABORATORIES	Attendee	Registered
SHEN J DILLON	LEHIGH UNIVERSITY	Poster Presenter	Registered
TABBETHA A DOBBINS	LOUISIANA TECH UNIVERSITY	Attendee	Registered
SREYA DUTTA	LEHIGH UNIVERSITY	Poster Presenter	Registered
BENJAMIN M EICK	PURDUE UNIVERSITY	Poster Presenter	Registered
ANTONIO FETEIRA	UNIVERSITY OF SHEFFIELD	Poster Presenter	Registered
FILIPE M FIGUEIREDO	UNIVERSITY OF AVEIRO, CICECO,	Poster Presenter	Registered
JUERGEN FLEIG	VIENNA UNIVERSITY OF TECHNOLOGY	Speaker	Registered
GLEN FOX	RAMTRON INTERNATIONAL CORP	Speaker	Registered
DAVID FULLWOOD	DREXEL UNIVERSITY	Speaker	Registered
R. EDWIN GARCIA	PURDUE UNIVERSITY	Speaker	Registered
EDWARD P GORZKOWSKI	NAVAL RESEARCH LABORATORY	Poster Presenter	Registered
OLIVIA A GRAEVE	UNIVERSITY OF NEVADA, RENO	Attendee	Registered
DAVID L GREEN	UNIVERSITY OF VIRGINIA	Speaker	Registered
KEVIN A GROSSKLAUS	PURDUE UNIVERSITY	Poster Presenter	Registered
JASON GRUBER	CARNEGIE MELLON UNIVERSITY	Attendee	Registered
JOHN W HALLORAN	UNIVERSITY OF MICHIGAN	Discussion Leader	Registered
CAROL A HANDWERKER	PURDUE UNIVERSITY	Attendee	Registered
JOHN S HARDY	PACIFIC NORTHWEST NATIONAL LABORATORY	Poster Presenter	Registered
MARTIN P HARMER	LEHIGH UNIVESITY	Speaker	Registered

SARTHAK HAVELIA	CARNEGIE MELLON UNIVERSITY	Poster Presenter	Registered
RANDALL HAY	USAF	Discussion Leader	Registered
THOMAS R HINKLIN	SANDIA NATIONAL LABORATORIES	Poster Presenter	Registered
MARA J HOWELL	PURDUE UNIVERSITY	Poster Presenter	Registered
BRYAN D HUEY	UNIVERSITY OF CONNECTICUT	Poster Presenter	Registered
ALLEN H HUNTER	MICHIGAN TECHNOLOGICAL UNIVERSITY	Poster Presenter	Registered
BENJAMIN J IVERSON	PURDUE UNIVERSITY	Poster Presenter	Registered
EVA JUD	MIT	Attendee	Registered
SUK-JOONG L KANG	KAIST	Speaker	Registered
SUK JUN KIM	PURDUE UNIVERSITY	Poster Presenter	Registered
CHEKESHA LIDDELL	CORNELL UNIVERSITY	Speaker	Registered
KATHY LU	VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY	Poster Presenter	Registered
JIAN LUO	CLEMSON UNIVERSITY	Poster Presenter	Registered
MARTHA MECARTNEY	UNIVERSITY OF CALIFORNIA, IRVINE	Attendee	Registered
HERBERT M MILLER	CARNEGIE MELLON UNIVERSITY	Poster Presenter	Registered
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ERICA MURRAY	NORTHWESTERN UNIVERSITY	Attendee	Registered
MAI NG	UNIVERSITY OF CALIFORNIA, IRVINE	Poster Presenter	Registered
NINA ORLOVSKAYA	MICHIGAN TECHNOLOGICAL UNIVERSITY	Poster Presenter	Registered
NITIN PATEL	CARNEGIE MELLON UNIVERSITY	Poster Presenter	Registered
BURTON R PATTERSON	UNIVERSITY OF ALABAMA AT BIRMINGHAM	Speaker	Registered
CHRIS A PETORAK	PURDUE UNIVERSITY	Poster Presenter	Registered
BRIAN E PICCIONE	PURDUE UNIVERSITY	Poster Presenter	Registered
NICHOLAS POLOMOFF	UNIVERSITY OF CONNECTICUT	Poster Presenter	Registered
JOHN R PORTER	UNIVERSITY OF CALIFORNIA, IRVINE	Attendee	Registered
JEFFREY D REDING	PURDUE UNIVERSITY	Poster Presenter	Registered
MARKUS W REITERER	MEDTRONIC, INC.	Poster Presenter	Registered
MOR BARAM RITTERBAND	TECHNION	Poster Presenter	Registered
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MARCEL ROST	KAMERLINGH ONNES LABORATORY	Speaker	Registered
RACHEL C ROSTEN	MICHIGAN TECHNOLOGICAL UNIVERSITY	Poster Presenter	Registered
HILA SADAN	TECHNION	Poster Presenter	Registered
MEHMET A SAHINER	SETON HALL UNIVERSITY	Poster Presenter	Registered
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TOMOKO SANO	US ARMY RESEARCH LABORATORY	Attendee	Registered
MELISSA K SANTALA	UNIVERSITY OF CALIFORNIA	Poster Presenter	Registered
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OLIVER STEIGELMANN	YAGEO EUROPE B.V.	Attendee	Registered
SUSANNE STEMMER	UNIVERSITY OF CALIFORNIA, SANTA BARBARA	Speaker	Registered
LILI H TAHERABADI	UNIVERSITY OF CALIFORNIA IRVINE	Poster Presenter	Registered
MING TANG	MIT	Poster Presenter	Registered
PATRICK D TEPESCH	CORNING INCORPORATED	Attendee	Registered
KATSUYO S THORNTON	UNIVERSITY OF MICHIGAN	Speaker	Registered
VEENA TIKARE	SANDIA NATIONAL LABORATORIES	Speaker	Registered
SUSAN TROLIER-MCKINSTRY	THE PENNSYLVANIA STATE UNIVERSITY	Speaker	Registered
THOMAS TURPIN	PURDUE UNIVERSITY	Speaker	Registered
KENT J VANEVRY	PURDUE UNIVERSITY	Poster Presenter	Registered
ZHONG L WANG	GEORGIA INSTITUTE OF TECHNOLOGY	Speaker	Registered



JAMES A WARREN	NIST	Speaker	Registered
MARK L WEAVER	THE UNIVERSITY OF ALABAMA	Speaker	Registered
LETA Y WOO	LAWRENCE LIVERMORE NATIONAL LAB	Speaker	Registered
DAVID T WU	YALE UNIVERSITY	Speaker	Registered
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HONGZHI YAO	UNIVERSITY OF MISSOURI-KANSAS CITY	Poster Presenter	Registered
DUK YONG YOON	KAIST	Attendee	Registered
HUI-CHIA YU	UNIVERSITY OF MICHIGAN	Poster Presenter	Registered
ALEXANDRA ZEVALKINK	MICHIGAN TECHNOLOGICAL UNIVERSITY	Poster Presenter	Registered